

the adiabatic relations for liquid and gaseous ether: the rise of pressure and temperature when volume is decreased without escape of heat. It is obvious that similar relations are determinable for solutions, and probably with much greater facility. M. Alexéeff has made some measurements which might be utilised for this purpose; but they are far too few in number, and, moreover, the necessary data as regards osmotic pressure are wholly wanting. It would be possible by a series of differential experiments to ascertain the evolution of heat on increasing concentration, and so to arrive at a knowledge of the specific heats of the solution at constant osmotic pressure, corresponding to the idea of specific heat at constant pressure; and also of specific heats at constant concentration, corresponding to specific heats at constant volume. I do not know whether such researches would yield as accurate results as those we are at present carrying out, but they are at least well worthy of attention.

II. "Preliminary Notice of a New Form of Excretory Organs in an Oligochætous Annelid." By FRANK E. BEDDARD, M.A., Prosector of the Zoological Society. Communicated by Professor E. RAY LANKESTER, M.A., LL.D., F.R.S. Received February 19, 1891.

So far as our knowledge of the Oligochæta goes at present, the excretory system appears to consist either of one or more pairs of separate nephridia in each segment, or of a diffuse, irregularly arranged system of tubules with numerous external pores upon each segment, and often with numerous coelomic funnels in each segment; there may or may not be a connexion between the tubes of successive segments. All the aquatic Oligochæta have nephridia of the first kind; a large number of the terrestrial Oligochæta have nephridia of the second kind; there is occasionally in the latter forms a specialisation of part of the diffuse nephridial system into a pair of large nephridia; these species connect the two extremes. But in all these Worms the nephridia are contained in the coelom, though some of the connecting branches may be retroperitoneal; the ducts which lead to the exterior may branch in the thickness of the body wall, but there does not seem to be any extensive ramification and anastomosis of the tubes in the muscular layers of the body wall.*

I have recently found a remarkably different arrangement of the nephridia in an Annelid belonging to a new genus of Eudrilidæ. This family is chiefly noteworthy on account of the remarkable modi-

* 'Quart. Journ. Micr. Sci.,' vol. 28, Pl. xxx, fig. 1, *n*, and fig. 2.

fications of the reproductive organs, and the present genus is no exception to the rule in that particular; but it shows a further peculiarity in the structure of the nephridia; the arrangement of these organs in the clitellar region of the body is unique among Annelids, and is to a certain extent suggestive of the condition of the organs supposed to be nephridia in certain Nematodea. Throughout the body generally, as in other Eudrilids, the nephridia are paired; in the genital region I was struck, on dissecting the worms, by the apparent absence of nephridia. Sections through the body wall in this region show that the longitudinal and transverse muscular layers are traversed by a system of peculiar canals not at all like nephridia in appearance. These canals are not mere clefts between the muscular fibres, such as Kükenthal has described in his paper "Ueber die lymphoiden Zellen der Anneliden;"* such lymph spaces I have found in a good many Oligochaeta, but they never possess a definite wall. On the contrary, the canals which I describe here have a definite darkly-staining wall, with nuclei here and there. They resemble the blood vessels very closely, and might easily be confounded with them.

These vessels are arranged in a longitudinal and a transverse series with numerous branches and interconnexions. The longitudinal muscles are imbedded in a nearly homogeneous, transparent, connective tissue, which is of some thickness between the peritoneal epithelium and where the muscular fibres end. It is in the latter tract of tissue that the four principal longitudinal trunks run, corresponding in position to a line connecting the four successive pairs of setæ; there appear to be smaller longitudinal trunks, but the four principal ones run through several segments without a break; these longitudinal trunks are connected with a metamerically repeated system of transverse vessels; these lie between the transverse and longitudinal muscular coats, and appear to run right round the body. They are of considerable calibre, but not so wide as the longitudinal trunks; I could not detect any ciliation anywhere, and their walls are extremely thin. They give off numerous branches, which traverse the body wall in every direction, and form a finer meshwork of tubules; some of the branches run towards the epidermis, and although I could not detect in transverse sections the actual orifices, on account of the fineness of the tubes, I could make out at frequent points a slight modification of the epidermis which seemed to correspond to an external pore.

Upon fragments of the chitinous cuticle being stripped off and examined with a high magnifying power, the orifices were quite plain. They were much smaller than the nephridiopores of *Perichaeta*, but not so minute as to be confounded with the pores of the gland cells of the epidermis.

* 'Jenaische Zeitschr. f. Naturw.,' vol. 18 (1885), p. 319.

The system of tubes was everywhere accompanied by blood vessels; but, it is perhaps unnecessary to remark, there was nowhere any connexion between these tubes and the capillaries; no coagulated blood was in a single instance found in the excretory tubules.

In spite of their very different appearance, as well as arrangement, from the nephridia of other types, such as *Perichæta*, which possess a diffuse nephridial system, the excretory nature of these tubes seems probable, without any further description. A connexion with the body cavity must be proved in order to remove all doubts as to their nature; in each segment, just behind the pair of setæ, the longitudinal duct gives off a branch, which passes through the peritoneum and comes to lie in the cœlom; this branch continues for a short distance, and then abruptly ceases; whether it is furnished with an actual orifice or not I am unable to say. In a few cases, the branch entering the cœlom became connected with a very small coiled nephridial tubule, so small that it was not, as already mentioned, recognisable in dissection.

I am inclined to refer the atrophy of the intra-cœlomic part of the nephridia to their having been used up in the formation of the genital ducts. I have recently communicated to this Society a notice of the development of the genital ducts out of nephridia in *Acanthodrilus*;^{*} and that mode of development is possibly general. In any case the nephridial system of the genital segments of this *Eudrilid* consists almost entirely of a complex system of tubes, which ramify in the thickness of the body wall, which open by numerous pores on to the exterior, and are connected by a few short tubes with the body cavity. If the tubes leading to the cœlom became obliterated, and they are very short as it is, the excretory system would consist only of the network in the body walls.

This system of tubes in the skin may perhaps be more comparable to the nephridial network of Cestodes and other flat Worms, than the intracœlomic network of other Oligochæta; its presence, however, in the body walls suggests a comparison with the Nematodea, which appear to possess at least the remains of a cœlom. In some of these Worms a system of fine tubes connected with the excretory pore permeates the interspaces between the longitudinal muscles. In *Echinorhynchus* the tubes connected with the lemnisci also ramify in the integument, and the lemnisci themselves are processes of the body wall depending into the cœlom.

* 'Roy. Soc. Proc.,' vol. 48, 1891, p. 452.